Earth System Science (ESS)/GLOBE Collaborative Teams: A process to build and support teams for ESS education

Image Credit: M. Ruzek

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Executive Summary

The University Corporation of Atmospheric Research (UCAR) GLOBE Implementation Office (GIO) and the UCAR Center for Science Education (SciEd) facilitated the development of seven Earth System Science (ESS) Collaborative Teams with remote learning opportunities over two-years culminating in a workshop in July 2022. The purpose of this project was to study how the ESS collaborative model, developed in Colorado, could be replicated, and adapted across GLOBE regions. Objectives of the workshop included:

- Generate discussions between and among teams to share ideas, resources, and expertise; to increase collaboration and improve ESS education within their defined area of influence; and
- Develop/refine short/mid-term plans and define participating networks to accomplish the objectives relevant to improving ESS education.

Initially, it was important to articulate and communicate the vision of the project, develop a recruitment plan, and design and distribute the application among US GLOBE Partners. After review of the applications based on the expertise/experience of the team leads, alignment of goals, and the composition of proposed teams, seven collaborative teams were accepted. Criteria for selections were based on demonstration of leadership, diversity of the team and commitment of the members to support each other, variety of audiences reached, geographic range, and engagement in ESS/GLOBE. This initial effort required frequent communications between project developers, team leads and their prospective team members, and between team leads, their members and the project team.
Once selected the project leaders worked to define a process to support ESS collaborative team development within the seven teams. This phase again was very reliant on frequent communications. Team development was envisioned as an organic process from within each team. There was no 'blueprint' or requirement from project leaders but rather encouragement, suggestions, and resources. An unforeseen impact on this phase was the COVID-19 pandemic. The restrictions placed on travel and in person gatherings required a strong effort to facilitate communications with the tools at hand. Websites for each team and the project were supported on the GLOBE website while using Internet based conference tools (such as ZOOM), newsletters, and email, all provided avenues for collaborative efforts to evolve within each team.

With the COVID-19 travel restrictions lifted in late 2021, a series of virtual meetings with the teams determined their priorities for an in-person workshop in the summer of 2022. Project Leads worked with an internal evaluator to develop questions to both assess the priorities from the teams for the workshop and to develop survey questions to assess the extent to which its

goals were met. Project leads then used the priority questions to engage teams in a conversation to develop the workshop agenda. Climate Change was a topic of interest as well as time to meet as a team. Strong support was expressed for ways to reconvene as a larger, all teams group in the future which could include scheduled get-togethers at such events as GLOBE Annual Meetings or GLOBE North American Regional Meetings.
Based on the observations and evidence collected from this two-year project, the approach employed was viable to build and support ESS education and outreach collaborative teams across geographic locations in the United States, thus replicating the Colorado model.

For any questions or comments on the ESS Collaborative project, please contact:

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About the Project

The University Corporation of Atmospheric Research (UCAR) GLOBE Implementation Office (GIO) and the UCAR Center for Science Education (SciEd) facilitated the development of seven Earth System Science (ESS) Collaborative Teams with remote learning opportunities over two-years culminating in a conference workshop in July 2022. The conference provided existing and prospective GLOBE (Global Learning and Observations to Benefit the Environment) Partners and other organizations working in ESS education with an adaptive model to work collaboratively and leverage existing resources and expertise to increase impact on STEM Earth System Science. The conference was facilitated by members of the Colorado ESS GLOBE Collaborative with participation from the assistant GLOBE Program Manager at NASA, the director of the GIO at UCAR, and the US GLOBE Country Coordinator. Seven ESS/GLOBE Collaborative Teams with thirty participants in total attended the workshop. Teams included ESS organizations from the Northeast U.S., Western New York, Midwest U.S., Colorado, California, and two cross state teams led by minority serving institutions.

Overview of CO ESS/GLOBE Collaborative

In 2016 two GLOBE partners in Colorado co-hosted the 20th GLOBE annual meeting in Estes Park Colorado. Following this successful meeting June 2017, these partners decided to host a meeting of all the GLOBE partners (past and present) along with others interested in ESS education in Colorado to determine the potential of re-invigorating GLOBE and ESS education in the state. Invitees included CIRES Education and Outreach from the University of Colorado, Boulder, the Education and Outreach Center in the College of Natural Sciences at Colorado State University, Metropolitan State University of Denver, St. Vrain Valley Schools, Fiske Planetarium at the University of Colorado, and the UCAR Center for Science Education. The initial goal of the collaborative was two-fold:

1. Determine how GLOBE can be instrumental in leveraging networks and partnerships and
2. determine the range of possibilities to integrate GLOBE in seamless collaborations with organizations for sustainable programming and professional development.

Since these initial meetings, the goal has broadened beyond GLOBE. Based on the identified synergies, the group continued to meet quarterly over the next several years at different locations and engaged in the following activities: presenting and exhibiting at the Colorado Science Conference, attending a webinar on GLOBE Science Schools funding model in the Netherlands, developing a catalog of ESS collaborative team member's resources and

opportunities, hosting GLOBE students from South Korea, adding a partnership with Community Collaborative Rain, Hail, and Snow Network (CoCoRaHs), touring the Innovation Center at St. Vrain Schools, providing multiple GLOBE workshops at Wiggins Elementary School, presenting a teacher workshop at the Colorado State Science Fair, exhibiting at the Erie Colorado Earth and Arbor Day festival, hosting the opening reception for the Southwest Regional GLOBE Student Research Symposium in Boulder CO, and participating in teacher training for the NSF ITEST funded MultiSTEM project at Metro State.

Project Objectives

Based on the success of the Colorado collaborative, the director of the GIO encouraged UCAR SciEd to develop an NSF conference/workshop proposal to study how the ESS collaborative teams could be replicated and adapted across the different GLOBE regions. The objectives of the workshop included:

- Generate discussions between and among team members to share ideas, resources, and expertise; to increase collaboration and improve ESS education within their defined area of influence
- Develop/refine short/mid-term plans and define participating networks to accomplish the objectives relevant to improving ESS education

These objectives align with the Community Goal 2 (CG2) of the GLOBE Strategic Plan: "Increase interactions and collaborations among local, regional and international GLOBE communities through events and activities."

The proposal included using an adapted Collective Impact framework, (Kania and Kamer, 2011) to guide the work. The following list describes how the conditions of the Collective Impact framework were adapted and actualized.

- Common Agenda: Participation in ESS and the development of mission/vision for each collaborative team
- Shared Measurement System: GLOBE partner surveys, protocols, and interviews/surveys
- Mutually Reinforcing Activities: Meet Ups/Webinars, ESS Resources on Padlet, Workshop
- Continuous Communication: Project E-Newsletter, Team Meetings
- Backbone Organization: GLOBE, GLOBE Implementation Office, and Project Leads

Evolution of Project Delivery (changes due to pandemic)

The proposal was funded in early 2020. Due to the COVID-19 pandemic and associated travel restrictions, the project leads were unable to convene the conference/workshop in the fall of 2020 as proposed. Following consultations with the NSF program officer, the format of the project was altered to include online webinars and local virtual meetings in 2020-2021 (originally intended to be done after the conference/workshop) to have participants articulate their mission, vision, objectives, and begin to learn from each other. In July 2022, a conference workshop was convened for members of the ESS Collaborative teams in Estes Park Colorado. The meeting agenda (Appendix A) was based on the identified priorities from the individual virtual meetings with team leads/members.

About ESS Collaborative Teams

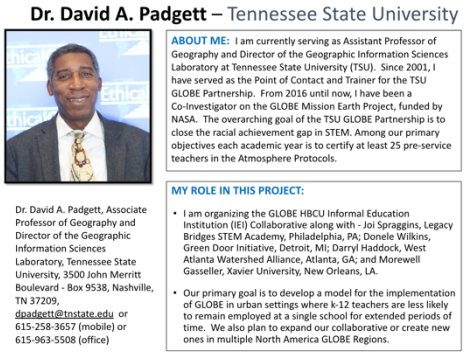
Process of Developing Collaborative Teams in the Context of ESS Education

ESS Collaborative Teams have the potential to transform Earth system science and GLOBE partnerships in the United States from primarily partners working within their sphere of influence (isolated impact) to a collaborative approach where resources and expertise are leveraged, and reach is extended. By working together on team defined issues and challenges of common interest participants in ESS Collaborative teams can work together to develop and implement projects that address issues/challenges that are common to each participating organization/individual and leverage resources and expertise to accomplish their overall goals.

Project Implementation

Recruitment began through email communication about the development of ESS Collaborative teams with existing GLOBE Partners and ESS organizations from different GLOBE regions in the United States. The project team developed an opportunity letter and application which were shared at two informational webinars in April of 2020. After review of the applications based on the expertise/experience of the team leads, alignment of the goals with project goals, and the composition of proposed team members the following seven collaborative teams were accepted into the project:

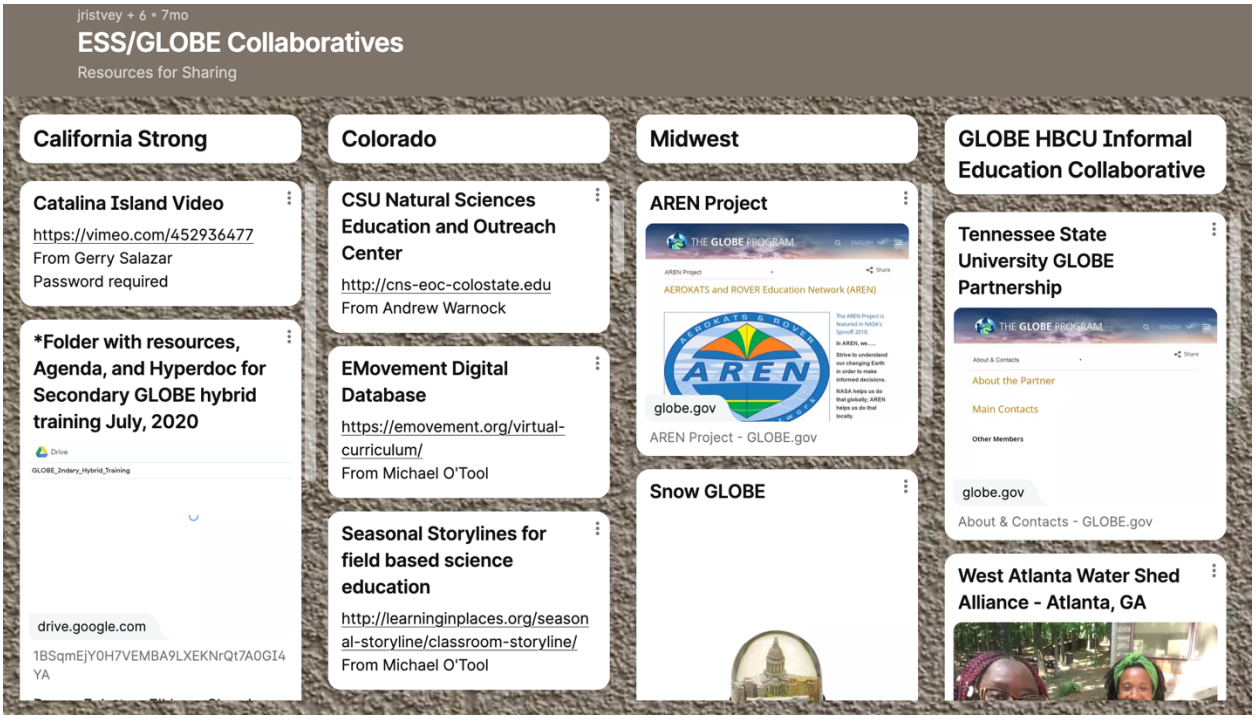
- California Strong: Tracy Ostrom University of California Berkeley, Team Lead
- Colorado, Noah Newman, CoCoRaHs, Team Lead
- HBCU/Cross Regional: David Padgett, Tennessee State University, Team Lead
- Just Science/Cross Regional: Garry Harris, Center for Sustainable Communities/SMART Academy Center of Excellence, Team Lead
- Midwest: Dave Bydlowski, Wayne RESA, Team Lead
- New England: Peter Garik, Boston University, Team Lead
- New York: Mike Jabot, SUNY Fredonia, Team Lead



Following team lead virtual meetings in August and October 2020, the team leads were encouraged to meet with their teams to begin developing the mission/vision of their collaborative teams. To facilitate these meetings, the project leads developed a webpage on the GLOBE website with links to Google folders to organize their work. In the team folders, participants were encouraged to develop "bioslides" using a common PowerPoint template for participants to share relevant information for both their collaborative team members and those in other collaborative teams. Team meetings provided opportunities to develop the focus of each collaborative team. Other collaboration/communication tools included an ESS resource

Padlet for individuals to provide information and links to ESS education resources and E-newsletters that featured announcements and some of the asynchronous work from the collaborative teams. From 2020-2022 optional webinars were provided to encourage cross team sharing and collaboration. The topics of the webinars were:

- *Putting Citizen Science to Practice*. January 2021 by Noah Newman, Colorado Climate Center
- *NASA Resources: Connecting Students to Science*. March 2021 by Peter Falcon, NASA JPL
- *GLOBE Web and API Webinar*. May 2021 by Angel Roller and Eslam Khair, GLOBE Implementation Office (GIO)
- *Data Puzzles Making Sense with Science*. July 2021 by Katya Scholoesser, University of Colorado CIRES: Colorado Collaborative



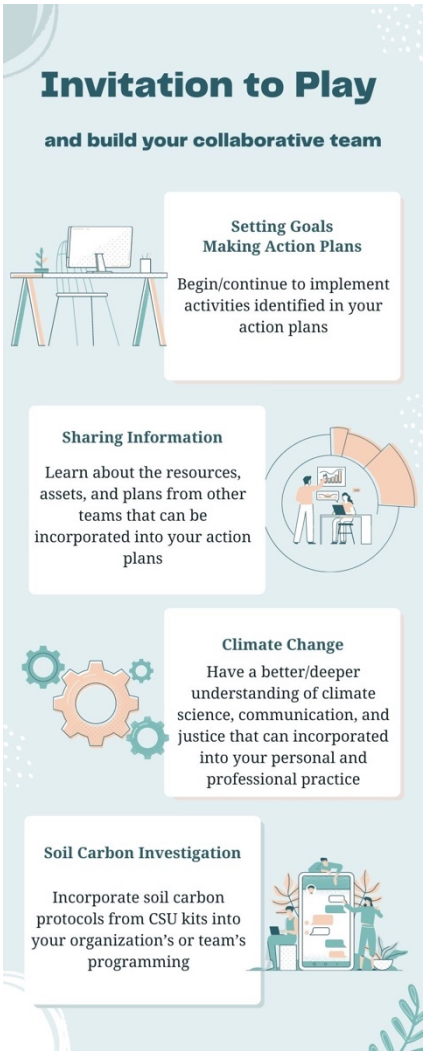
At the end of the project, a discussion board was created and added to facilitate cross-team conversations generated at the 2022 conference workshop.

With the COVID-19 travel restrictions associated with the global pandemic slowly coming to an end in late 2021, a series of virtual meetings with the team leads/team members to understand their priorities for a potential in-person meeting in the summer of 2022 were convened. Virtual meetings occurred from September 2021-January 2022. Project Leads worked with an internal evaluator to develop questions to both assess the priorities from the teams for the summer face-to-face meeting and to develop survey questions to assess the extent to which conference/workshop goals were achieved. Project leads then used the priority questions to engage team leads and collaborative team members in a conversation to help form the agenda

for the summer meeting. The responses to the following questions were recorded before, during, and after the virtual team meetings:

- Question 1: What would your team like to accomplish at a summer face-to-face meeting? Are there specific topics, presenters, or agenda ideas that would help you achieve this?
- Question 2: What support would you need to make this meeting meaningful to your team?

Figure 1 Invitation to Play infographic for face-to-face meeting/workshop



The responses to the questions could be categorized into the following ideas:

- Setting goals and making action plans: Begin/continue to implement activities identified in our action plans (team time)
- Sharing information and networking: Learn about the resources, assets, and plans from other teams that can be incorporated into our action plans (cross-team conversations)
- Climate change: Develop a deeper understanding of climate science communications and justice which can be incorporated into our personal and professional practice (panel discussion)
- Outdoor science investigation: Incorporate/adapt soil carbon protocols from Colorado State University kits into our organizations or teams programming (investigation)

Based on this feedback, the Project Leads developed an agenda and determined speakers/activities to accomplish these priorities during the face-to-face time. The following were the meeting objectives. Figure 1 shows a summary of the feedback through an infographic: Invitation to Play. Please see Appendix A for an outline of the meeting agendas for the face-to-face conference workshop.

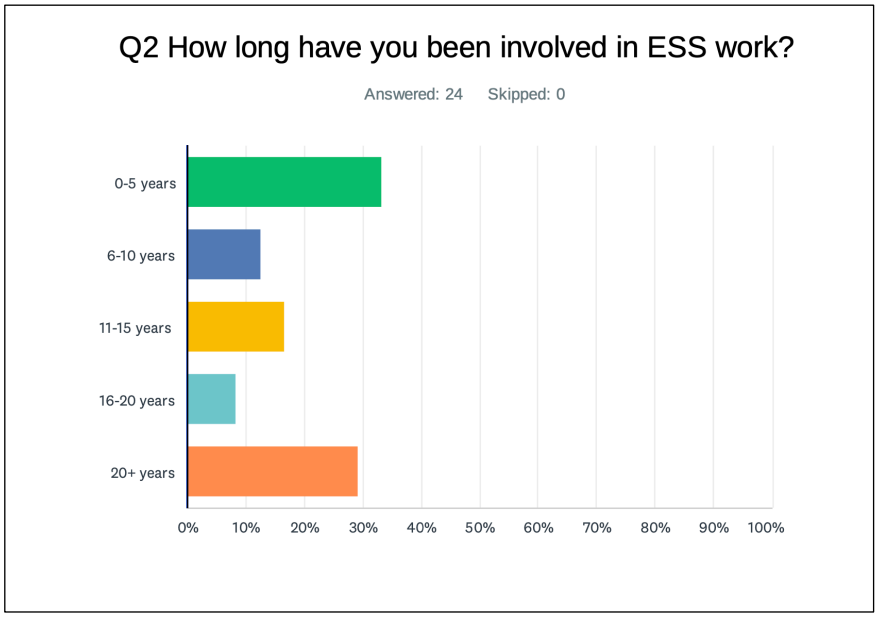
Each team would:

- Generate discussions between and among team members to share ideas, resources, and expertise; to increase collaboration and improve ESS education within their defined area of influence

- Develop/refine short/mid-term plans and define participating networks to accomplish the objectives relevant to improving ESS education

Conference/Workshop Findings and Elements for Effective Collaborative Team Meetings

This section provides what was learned from the project. First, the findings of overall participant feedback about the conference/workshops based on the post meeting survey results are shared. Next, findings from multiple data sources in the form of team profiles are provided. Finally, based on a synthesis of all the information collected from the three-year project, key ingredients for how ESS education collaborative teams could be developed and sustained across different geographic regions of the United States are listed.



Profile of Conference Workshop Participants

There was a total of thirty participants at the workshop. Twenty-three participants completed the survey at the end of the workshop. When responding about the experience participants had on ESS education, 33% of the participants responded zero to five years, 12.5% responded six to ten years, 16.7% responded eleven to fifteen years, 8.3% responded 16-20 years, and 29.2% responded over twenty years. When asked about the type of organization they are affiliated with, 15 responded college/university, 5 responded nonprofit, 2 responded informal science education center, 1 responded K-12 education, and 1 responded NASA/JPL.

Overall Conference Workshop Post Meeting Evaluation

At the conclusion of the face-to-face meeting at Estes Park, Colorado in July 2022, a survey was administered to the participants to understand individual perspectives about the work conducted over the two-day meeting. Twenty-three (77%) of the onsite participants completed the twelve-question survey. The following are the overall findings from the survey results. Seven respondents were from the Colorado collaborative, four were from California Strong and the New York collaborative and two respondents each from the Midwest, HBCU, New England, and Just Science collaboratives.

Overall Satisfaction

A majority of the survey respondents had positive responses about the conference workshop. Ninety-five percent rated their overall satisfaction with the meeting as Very Satisfied (93%) or Satisfied (2%). Comments included, “Getting to know folks I have heard about but not met was valuable and meeting folks interested in the same things I am is heartening” and “Our Team REALLY needed this time to plan. It was great to have a scaffold for an action plan to work from.” Ninety-six percent rated that the activities and exercises were helpful for your team's action planning. Comments included, “Seeing people's reactions to our activities was very useful. Sometimes we get too stuck in the weeds and don't get to appreciate the perspective of other ESS education and outreach folks.” and “Providing time for collaborating. The action plan form was helpful in directing our conversation and organizing our ideas.”

All the survey respondents agreed that the meeting provided motivation to continue their collaborative teamwork and collaborate in the future. All respondents said they are more motivated to work collaboratively with my project team following this meeting (87.5% Strongly Agree, 12.5% Agree). All respondents said that it was very likely (79%) or likely (21%) that they would continue to collaborate on common ESS projects. Ninety-six percent said that it was very likely (67%) or likely (29%) that they would continue to participate in GLOBE and/or citizen science activities. Most of the respondents agreed that the different activities in the meeting

were either very useful or useful to meeting their objectives. One participant stated that the climate panel was “not at all useful” and one participant stated that the team presentations were “not so useful.” The team profiles in Appendix B contain some of the comments from participants about each of the agenda activities.

Most survey respondents thought there was adequate time provided for the work that needed to be done. Seventeen of the respondents stated that the amount of time for collaboration was adequate while seven participants stated that they would have liked more time for collaboration. When asked about their satisfaction of overall structure of the meeting agenda, 19 respondents indicated strong satisfaction and 5 were satisfied with the structure. Twenty-three respondents strongly agreed (21) or agreed (2) that the information provided was useful for team planning. As a result of the meeting 21 respondents strongly agreed and three agreed that they were “more motivated to work collaboratively with their project team.” Finally, twenty-three respondents were very likely (18) or likely (5) to follow-up with other participants or teams. For a complete report of the survey results, please contact Project Lead John Ristvey (jristvey@ucar.edu).

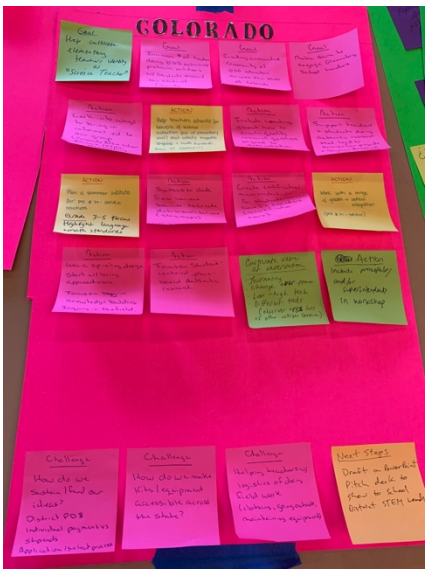
Team Profiles

Following the in-person conference workshop in Estes Park the Project Leads reviewed the following information to prepare team profiles (See Appendix B): Composition of each team (both those in attendance and not in attendance), expertise as indicated in their application, the mission/vision statements, identified theme(s) and priorities from the action plans and feedback from the survey.

Elements of an Effective In-person Collaborative Team Conference Workshop

Based on the findings from the conference/workshop, four elements were identified that are important in providing structure and space for building and supporting ESS collaborative teams. The most important element is to have conversations with team leads and team members to determine priorities and then to build the agenda that include the priorities. While structuring the meeting around the pre-identified priorities is important, the agenda should also be flexible

enough for the team members to manage their time to accomplish their team goals. A second element is to have both time for the collaborative teams to meet with each other to develop action plans (team time) and encourage and share opportunities, resources, and ideas with other teams (cross-team conversations). An action plan template (see Appendix C) was provided to the teams which gave a structure to document their plans. A third element is related to the cross-team conversation time: unstructured networking. It is a common finding at professional meetings and conferences for participants to want more time for networking. This request was not in our evaluation because it was built into the expectations that all the activities allowed for informal networking to happen. Networking also occurred during meals and leisure activities in the evening. The outdoor mountain setting of the YMCA camp of the Rockies provided an inspiring setting for productive work and meetings with others. Finally, it is important to have a facilitator that can guide the pace of the meeting and adjust the agenda to accommodate team and individual needs to maximize productivity.

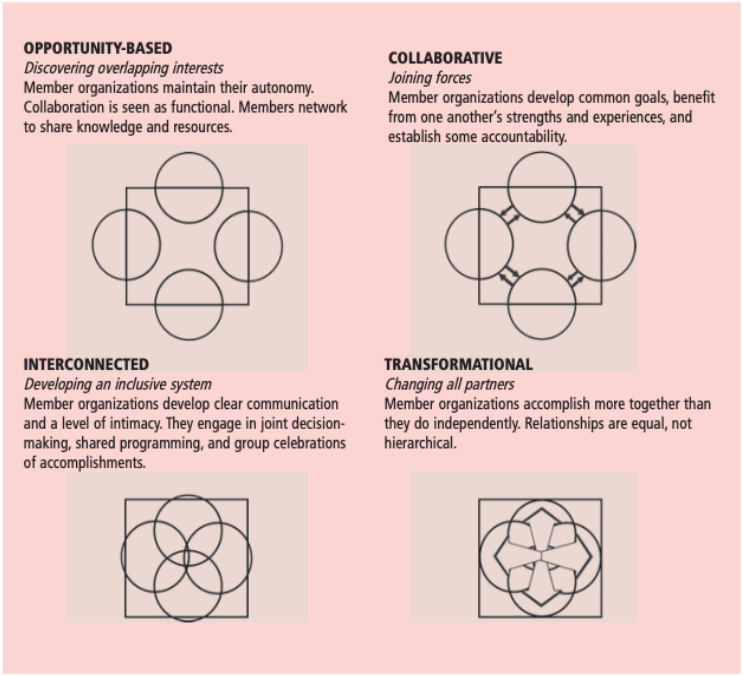


Typology, Characteristics, and Key Ingredients for Building and Supporting ESS Education Collaborative Teams

Typology of ESS Collaborative Teams

Most of the collaborative teams that participated on this project can be classified by two of the typologies identified by Allen, 2000, Noam and Tillinger, 2004), see Figure 2. Teams typically begin as 'opportunity-based' who maintain their autonomy and learn about each other's work together and then over time gradually move toward 'collaborative' in which they identify common goals, benefits, and some accountability. Through the course of this project, none of the collaborative teams transitioned to 'interconnected' or 'transformational' though a couple

Figure 2. Partnership Typology
Source: Noam & Tillinger, 2004



of teams have demonstrated some elements of an inclusive system such as regular communication and some shared programming.

Characteristics for Successful Collaborative Teams

The following includes key ingredients for building and sustaining ESS education collaborative teams. Over the two years of the project (see *Process of developing collaborative teams in the context of ESS Education* on page 2), several characteristics that make for a good collaborative team were discovered. One of the most important is having a team leader with a vision for what the collaborative team can accomplish, relationships with other ESS providers, and the leadership skills to motivate and inspire the individuals toward a common mission and vision. Similar to what occurred with the Colorado collaborative at the beginning of this endeavor, having regular team meetings is important to enable check-ins, progress reports and to maintain momentum of individual and group priorities. Finally, having team-defined success criteria for all projects provides a means to track progress over time.

Key Ingredients of Collaborative Teams as Identified by Team Leads

Five months after the face-to-face workshop in Estes Park, a short questionnaire asking team leads to reflect on the 'key ingredients' for their work as an ESS Collaborative Team before or after the workshop was distributed. What follows are direct quotes from the team leads.

California Strong

"The application process and the subsequent information meetings early in the project were essential in learning about potential members of our collaborative. Afterward I met with one of the participants of the informational meeting to inquire about combining forces between Northern and Southern California and to identify the need for folks to work together and opportunities to do things together. Once we started meeting it was useful to see how working together had the potential to benefit individuals and organizations. Other ingredients included commitment and passion, a willingness to support each other's programs, and the understanding that we are not here by ourselves— we had the support from the project leads (Deanna/John) that reinforced our commitment to build a collaborative, it was not about the funding but about having a mission/vision statement at the beginning of the project that led to commitment."—Tracy Ostrom (via interview)

Colorado
"I think one of the key ingredients is to simply keep the ball rolling. Before Estes, we sometimes didn't communicate as regularly, but on the runup and through/after Estes we've been much better at keeping to a schedule with regular meetings. The second key ingredient is meeting in-person. That always makes a difference."—Noah Newman (via email)

GLOBE HBCU Informal Education Collaborative
"Working towards increased regular communication between myself and Joi Spraggins after meeting her in person for the first time at Estes Park. Sharing opportunities for funding with collaborators and writing proposals."—David Padgett (via email)

Just Science
"Persistence and maintaining a broad approach."—Garry Harris (via email)

Midwest
"We have a lot of people interest in GLOBE and active GLOBE Partners."—Kevin Czaijkowski (via email)

New England
"I think the main ingredient is the belief that each of us has something valuable to offer for growing our respective programs."—Peter Garik (via email)

New York
"I think that main ingredient to our success, during and post Estes in particular, has been the incredible efforts of team members here and the support offered by you (John) and Deanna"—Mike Jabot (via email)

Conclusion

Based on the original proposed objectives for this project, based on the observations and evidence collected from this two-year project, the approach employed was viable to build and support ESS education and outreach collaborative teams across geographic locations in the United States. While the Collective Impact framework was a useful starting point and offered some structure to the project, it was more of an implicit model that grew and evolved over the span of the project. Themes included microplastics, while processes involved existing and creating new networks such as solar system ambassadors, integrating GLOBE into National Estuarine Research Reserve System, creating a connected community of ESS educators across the state, in person GLOBE training with junior ROTC instructors, inquiring about resources for GLOBE partnership, working with teachers to see the justice aspect of science, encouraging more teachers to attend NARM/GLOBE Annual meeting, requesting Park Services staff [National and State] to present for a variety of audiences, and broadcasting GLOBE ESS opportunities on a state career and technical education (CTE) listserv).

Future Plans

One of the requests that was made prior to the conference workshop was to provide information about possible funding opportunities to further the ESS education efforts that were worked on during this meeting. A decision was made not to have this be part of the agenda. However, the project leads have scheduled a webinar called “Ideas to Impact” by Barbara Ransom from the National Science Foundation in December 2022. As this conference project winds down, many collaborative teams will continue to work on their objectives. Updates will be provided at the regional/local level with some ongoing work being shared at professional conferences such as the North American Association for Environmental Education (NAAEE), American Geophysical Union (AGU), and the GLOBE Annual Meeting.

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Appendix A: Conference Workshop Agenda

Agenda Thursday July 7:

- Check in
- Cross team networking
- Group dinner

Agenda Friday July 8:

- Breakfast
- Group introductions
- Overview of meeting goals and objectives
- Collaborative team working meetings (team time)
- Sharing out: ideas on poster boards (cross team conversations)
- Working lunch: Birds of a feather discussions
    - GLOBE: Dr. Amy Chen, Dr. Tony Murphy, Jen Bourgeault
    - National STEM Ecosystems: Dr. Janelle Johnson
    - Citizen Science: Noah Newman
    - Others
- Climate Change Presentations (facilitated by Noah Newman)
    - The Physics of Climate Change by Dr. Peter Goble (Colorado Climate Center)
    - Climate Change Solutions and Adaptations by Dr. Richard Wagner (Metro State)
    - Talking with Students about Climate Change by Dr. Holly Olivarez (University of Colorado Boulder)
- Soil Carbon Investigation (facilitated by Dr. Andrew Warnock, Courtney Butler and Karina Hassell Arquinez (Colorado State University)
- Cross team networking
- Dinner
- Post dinner outdoor activities

Agenda Saturday July 9:

- Breakfast/meetings
- Team working time
- Team presentations
- Wrap up, evaluation, and next steps

Appendix B: Team Profiles: Themes, Discussions, and Actions

The following are one team profiles of each of the ESS Collaborative Teams. The profiles contain a list of the team members, their mission/vision, a snapshot of the themes and priorities that the team has identified that is important to the work in their geographic region, and their feedback about the workshop meeting.

Team Name: California Strong

Members:

- Tracy Ostrom (UC Berkeley) Team Lead, online
- Svetlana Darche (WestEd), present
- Peter Falcon (NASA/JPL), present
- Matt Ferner (SanFrancisco National Estuarine Research Reserve) present
- Kay Ferrari (NASA/JPL), online
- Peggy Foletta (Elkhorn Slough National Estuarian Research Reserve), present
- Gerardo Salazar (Los Angeles Unified School District), present

Mission/Vision:

- Deepen our earth system science practices, expand public engagement in outdoor earth system science/GLOBE education, and share resources to support existing and new ESS/GLOBE programs.

Themes/Meeting Conversations:

- Integrate GLOBE into NOAA/National Estuarine Research Reserve System (NERRS): connect GLOBE students to scientists, place-based data sharing, network of GLOBE training sites
- Elkhorn Slough Reserve--converting informal to formal: GLOBE kits--Water quality, carbon sequestration, canopy cover/ground cover
- Microplastics monitoring protocol, collaborating with Australia and Italy, tested in classrooms in CA, testing quantitative data output now
- Implementation of GLOBE throughout all Office of Environmental Education OOEE programs: overnight science schools, field studies, eco vans
- Solar System Ambassadors GLOBE training: train SSA to train teachers and science partners
- GLOBE Slovakia international collaboration: Write 'how to guide' on international collaborations, collaborate with 10 schools in Slovakia and Schools in CA, work with US embassy and country coordinators

Action Plan/Team Presentation:

- Looking at the strengths of the members of the team. Passionate about sharing our work with others in formal/informal settings (outreach) and a national network (solar system ambassadors)
- Microplastics: Expertise from Matt from the team and internationally through GLOBE

- Carbon sensors for students in formal/informal setting--LA Unified/Elkhorn Slough, Compton LA and Northern CA
- Each year (we) will make decisions based on capacity of what we will continue to do. Bringing CA Strong as a recognized resource for educators

Survey Feedback:

- Overall: “This meeting did a great job of blending serious thinking/planning with networking, so we were able to build relationships as well as content knowledge.”
- Networking: “National scope of attendees was superb.”
- Team time: “We work together already but in person time was valuable (CA is a big state, and the pandemic has been tough)” “Face to face with other teams around enhanced our interactions. We were able to deepen our discussions together.”
- Learning: “Yes, I learned about the great ideas that other regions were working on. I would love to incorporate the ideas in our region.”
- Soil carbon: “Great timing for me. I'm doing Carbon in the forest activities and want to extrapolate to fires, and the added soils activities package was great including the real soil from a fire and background data and variety of GLOBE-inspired protocols for younger kids.”
- Meeting activities: “I have so many new ideas to take back to my colleagues. Really appreciate that.”

Team Name: Colorado

Members:

- Noah Newman (Colorado Climate Center) Team Lead, present
- Bec Batchelor (University of Colorado)
- Courtney Butler (Colorado State University), present
- Karina Hassell (Colorado State University), present
- Briana Aldeline Ingerman (University of Colorado)
- Janelle Johnson (Metropolitan State University), present
- Michael O'Toole (St. Vrain Schools)
- John Ristvey (UCAR), present
- Deanna TeBockhorst, present
- Andrew Warnock (Colorado State University), present

Mission/Vision:

- Partners in Colorado who collaborate to leverage ESS/GLOBE assets and organizational resources to improve Earth system science education

Themes/Meeting Conversations:

- Creating a connected community of ESS educators across the state of Colorado.
- Increase number of teachers doing ESS activities/protocols outdoors with students in Colorado.
- Make sure to engage elementary school teachers, help cultivate elementary teachers' identity as 'science teacher.'
- Focus on student centered/place based authentic research
- Cultivate the value of observation: journaling, change over time, low-high tech, different tools.
- Help teachers advocate for benefits of science instruction that supports language and math standards.
- Create certificates/micro credentials for student service hours and teacher recertification hours.

Action Plan/Team Presentation:

- Plan/pilot a summer institute for Pre/Inservice teachers
- Geo/biodiversity that are part of Colorado that could be replicable in other states/regions
- Increase number of teachers and create a community of practice in ESS across the state
- Focus on elementary teachers' 'identity' as a science teacher
- Involvement with school leadership

Survey Feedback:

- Overall: “This is a great group of people with a tremendous amount of expertise and energy! I really enjoy hearing what other people are doing and seeing their reaction to what we are doing.” “The meeting was most useful because of the great participants. The time was well used and great plans and community building. In person events always make a difference. The side conversations are extremely valuable. I loved this meeting. I was satisfied with the collaboration and time to network with others with similar interests as me.”
- Networking: “I met several people who I am going to make a real effort to visit and keep in touch with.”
- Team time: “Our team made some real headway in our planning for future teacher institutes.”
- Learning: “Many different things from other groups that we need to "repurpose" for our programs.” “Learning about common challenges among others. Lots more about my own team!”
- Soil carbon: “Beautifully done! Great example of GLOBE related but not GLOBE per se”
- Climate change: “This was very informative. I really liked Peter Goble's talk and learning more about specific climate impacts in Colorado.”
- Team sharing: “Every team had great ideas that we can borrow to improve our own plans. I especially liked hearing what the HBCU team is doing. They inspired me to strive to include DEIJ in everything we do.”
- Action planning: “Seeing people's reactions to our activities was very useful. Sometimes we get too stuck in the weeds and don't get to appreciate the perspective of other ESS education and outreach folks.”

Team Name: GLOBE HBCU Informal Education Collaborative

Members:

- David Padgett (Tennessee State University), Team Lead, present
- Darryl Haddock (West Atlanta Watershed Alliance)
- Morewell Gasseller (Xavier University)
- Joi Spraggins (Legacy Bridges STEM Academy), present
- Donele Wilkins (Green Door Initiative Inc.), present
- Jackie Williams (Legacy Bridges STEM Academy)

Mission/Vision:

- Draft a model for significantly increasing the numbers of youth, Inservice teachers and preservice teacher from populations underrepresented in STEM engaging with GLOBE resources via formal and informal educators.
- Collaborate on a GLOBE education design that is less dependent upon teachers remaining in place at one k-12 school. We envision a more sustainable model that builds more upon Partner-school relationship than teacher -school relationships. We also plan to be more open to informal educations institutions based in urban communities.

Themes/Meeting Conversations:

- Green Door initiative: Site visit, weather station, continued near peer collaboration
- Legacy Bridges STEM Academy: In person GLOBE training with JR. ROTC instructors, Inquire about resources for GLOBE partnership
- Xavier U. Air Quality project with Purple air sensors
- West Atlanta Watershed Alliance; Air quality project with Purple air sensors
- Comment: How can the larger GLOBE community learn from and support this group?

Action Plan/Team Presentation:

- Overarching goal: Close the racial achievement gap in STEM for students of color
- Challenge of teacher transients (leaving after one year)
- HBCUs produce half of the black teachers in US; HBCUs as a place to get preservice elementary teachers in to GLOBE and track them over the course of their career
- Short term goal: Site visits to the urban centers with preservice teachers
- Long-term Goals: 1) Meeting with HBCUs with faculty of colleges of education for training and certification for GLOBE; 2) GLOBE as part of science methods classes; 3) increase the number of informal education partners (girl scouts)

Survey Feedback:

- Overall: “Our team accomplished a great amount by meeting in person.” “Excellent experience, knowledge sharing of “Best Practices” and meeting my team members and other ESS team members.”
- Learning: “I learned about the thoughts and needs of my team members and what I can do to assist them.”
- Action Planning: “The time spent meeting with my team members, both formally and informally was most helpful.”

Team Name: Just Science

Members:

- Garry Harris (Center for Sustainable Communities/SMART Academy Center of Excellence), Lead, present
- Camelia Opukdu (Xavier University), present

Mission/Vision:

- Reducing inequalities and barriers for entry for women and girls in science
- Building capacity in underserved and marginalize communities through the use of science
- Building capacity in science education to create a 'Cradle to Career' pipeline for underserved and marginalized K-16 student with the aim of obtaining sustainable wage and career pathway development

Themes/Meeting Conversations:

- Poor people's campaign
- Strategic planning

Action Plan/Team Presentation:

- Spoke about their name "Just Science" and social innovation and enterprise-wide at Georgia Tech for social justice in science.
- Awarded NASA ROSES grant.
- Working with teachers to see the justice aspect of science.
- Advisors working to advance policy, financial and technical resources and community advocacy activism.

Survey Feedback:

- Overall: “I was able to meet with my team member and others who are interested in Earth Systems Science.”
- Soil carbon: “I have my own “kit” type projects and I will go back and work on them to share with a wider audience.”
- Team presentations: “Well coordinated, well structured, great content.”
- “This was a very organized and enjoyable meeting. Looking forward to future collaborations.”

Team Name: Midwest

Members:

- David Bydlowski (Wayne RESA-AREN), Team Lead
- Kevin Czaijkowski (University of Toledo), Present
- Sarah Nern (Purdue University)
- Michael Notaro (University of Wisconsin-M)
- Rosalyn Pertzborn (University of Wisconsin-M)
- Janet Struble (University of Toledo), Present

Mission/Vision:

- Expand and strengthen GLOBE interactions among citizens and schools/districts in the Midwest United States.

Themes/Meeting Conversations:

- More teachers to come to NARM/GLOBE Annual meeting
- Partners to make a profile

Action Plan/Team Presentation:

- Multischool collaborations: Partners working with teachers. Getting students to present more than once at Student Research Symposium (SRS).
- Promote local SRS and present each year as 'Bright Stars' This idea resonated with comments from other participants.
- Provide opportunities for team-based, student-led GLOBE based scientific research projects and collaborative events.
- Provide a regional focus that fosters multi-school/locale interactions.
- Increase Number/Participation of GLOBE Schools, Teachers, Citizens and Partnerships.
- Increase the input of quality GLOBE data.

Survey Feedback:

- Overall: “Very productive meeting, connected with other partners; It was a great chance to network and think about how to expand GLOBE in midwest.”
- Birds of a Feather: “I ended up talking more with someone who was new to GLOBE and helping them get started.”
- Soil Carbon/Action Plan: “It is surprising how learning about the carbon in soil helped us think about working with our teachers on a site we have.”
- Learning: “Learned what another collaborative are doing. Learned strategies used by other groups.”

Team Name: New England

Members:

- Peter Garik (Boston University), Team Lead, Present
- Joan Haley (Shelburne Farms), Present
- Haley Wicklein (University of New Hampshire)
- Evan Kuras (Boston University)
- Patricia Janulewicz Lloyd (Boston University)
- Donald McCasland (Blue Hill Observatory), Present

Mission/Vision:

- Share resources between the founding members of NERESS.
- Incorporate and adapt GLOBE, NASA, NOAA, and other science and science education resources in an increased number of school districts and informal science education venues; and support community action by students and citizens in communities that are predominantly of low socioeconomic status to advocate for positive changes in the quality of their environment.

Themes/Meeting Conversations:

- Can NASA make high level connections with organizations to encourage utilization of GLOBE and NASA resources for environmental education, formal, informal, and citizen?
- Scouting is at a transition point. We considered GLOBE Scouting badges
- GLOBE Mission Earth piggyback on Blue Hill's audience by offering PD points for MA teachers
- Park Services (National and State) to present for a variety of audiences
- Help and learn about how to address and accomplish JEDIA goals

Action Plan/Team Presentation:

- Connecting more with the national parks. Each national park offers their own educational activities.
- Taking advantages of each of our teams of the educational efforts (value added). Observatories are a great resource for educational opportunities for teachers. Universities can offer credits that teacher find as valuable.
- Enormous buy in for using GLOBE with partners but there are barriers to get it into the classrooms--relate it to climate change and sustainability. How can we reduce the burden of GLOBE in the classroom?
- Interested in STEM ecosystems as bigger than a collaborative teams.

Survey Feedback:

- Overall: “I was motivated by the ideas shared and diverse presentations. I was energized by the enthusiasm of others. I am encouraged by learning others have many of the same challenges.”
- Networking: “Getting to know folks I have heard about but not met was valuable and meeting folks interested in the same things I am is heartening.” “Connecting in person really moved things forward.”
- Team Time: “The meeting was my opportunity to sit with my team members and drill down on the best ways that we can work together. Such in-depth discussions are hard to maintain in the absence of an organized meeting with an agenda and a rubric.”
- Team Sharing: “As we are expanding programs and exhibit hall content it is great to see more resources available.”
- Climate Change: “Additional context and knowledge about climate change is always helpful and valuable.”
- Soil Carbon: “Learning how investigations can be done in different formats and with different resources but with a common theme.” “Aside from the wonderful materials, this provided a model for curriculum development for which I would like to work.”
- Action Plan: “We are still struggling with a specific plan of action but now we have more ideas for a direction to take.” “I fee that our team planning went well. On the other hand, I could have used more "forced" meeting with other teams. I could have benefited from hearing more of the planning by others.”
- Learning: “The additional networking and resource groups. Especially Solar System and STEM ecosystems.” Most of what I learned that was new was from my team members. I will definitely exploit access to the Parks Service whether national, state, or local.

Team Name: New York

Members:

- Michael Jabot (SUNY Fredonia), Team Lead, Present
- Paula Ferneza (WNY CAM P-Tech Academy), Present
- David Henry (Buffalo State College), Present
- Janeil Rey **(**Erie2 Chautauqua- Cattaraugus Board of Cooperative Educational Services), Present
- Mary Ronan (New York State Department of Environmental Conservation)

Themes/Meeting Conversations:

- Expand reach of ESS collaborative across content areas--more than just science
- Broadcast GLOBE ESS opportunities on a career and technical education (CTE) listserv
- What state level policies need to change to make this happen?
- Engage state-wide organizations and professional development providers
- Create regional CTE advisory

Action Plan/Team Presentation:

- Welcome CTE into our work. Original thinking was locally but now thinking about this work regionally.
- Comment: Connections with US Departments of Labor and Education as resources.
- Comment: CTE as another route to college rather than replacing college.

Survey Feedback:

- Overall: “Great networking and time to PLAN! We need this impetus to get us started on many projects.” “The conference was well structured to meet its goals. I was especially satisfied with the time built in to work in our local groups and the ability to meet and network with others.”
- Networking: “It was great to make connections and learn from the work of others. We have taken from what we learned and applied it to our own initiatives such as "Science Fridays" from Colorado State University.”
- Team Time: “Our Team REALLY needed this time to plan. It was great to have a scaffold for an action plan to work off of.” “Working without distractions and with shared references was a great opportunity.”
- Team Sharing: “Great ideas were presented that we want to replicate and even when it wasn’t something we could immediately use. It was a valuable perspective on the

diversity of ideas and projects" "I am bringing a lot of information back to share with both formal and informal educations."

- Climate Change: "Great panelists- very different approaches and information but also cohesive and hopeful" "Great connection to folks at the frontlines."
- Soil Carbon: "Putting oneself in the position of the student is always a learning experience and helps to remind us of our goals. This activity was very well organized, maintained engagement, was placed based, and provided a wealth of applications. The kits were exceptionally well designed."
- Action Planning: "The action plan template provided before we arrived was helpful as were the posters of the other groups showing the work they had done" "Providing time for collaborating. The action plan form was helpful in directing our conversation and organizing our ideas. The opportunity to "lock ourselves away" and plan was invaluable"
- Learning: "I learned from the climate panel and the soil exercise. I was really impressed by the kits and learned what a quality usable kit could look like and most importantly I learned there are people all over the country in the world doing this work. It gave me hope for our future" "I learned a lot more about Globe, STEM ecosystems, the work of Teams around the country, and so much more! It was great to get some updated information from the panelists too!"

Appendix C: ESS Collaborative Teams Action Plan Template

Name of Team:

Mission (previously developed or revised):

Identify three possible goals for your team to accomplish over the next year

1.

2.

3.

Objectives	Tasks	Success Criteria	Time Frame	Resources